Racial Income Disparities and the Measurement of Segregation*

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Abstract

Racial segregation in residential patterns remains pervasive in the United States. This persistence is usually attributed to some combination of neighborhood preferences over racial composition, discrimination in real estate and credit markets, and the effects of racial disparities in income. We propose a method for the decomposition of segregation measures into two components. One of these can be interpreted as the component of segregation that can be attributed to the effect of racial income disparities alone, while the other captures the combined effect of neighborhood preferences and discrimination. Applying the method to thirty major metropolitan areas, we find that the role played by racial income disparities in accounting for segregation is generally modest but varies significantly across cities.

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1 Introduction

Despite a modest decline since its high water mark around 1970, a high degree of racial segregation in residential patterns remains a striking feature of the urban landscape in the United States (Massey and Denton, 1993, Farley and Frey, 1994, Cutler et al., 1999, Lewis Mumford Center, 2001). African-American households, in particular, experience levels of segregation that far exceed those of other groups. Segregation is highest and most persistent in the older cities of the Northeast and Midwest, and in those with significant black populations. The two metropolitan areas with the largest black populations, New York and Chicago, both had black-white indexes of dissimilarity exceeding 80 in the year 2000 and similarly extreme levels of black-white separation continue to prevail in Detroit, Newark, Milwaukee and Gary.[1]

The pervasiveness of segregation has been attributed to some combination of neighborhood preferences, discrimination in real estate and credit markets, and the effect of racial disparities in income and wealth. The idea the relatively moderate preferences over neighborhood racial composition can give rise to extreme levels of segregation when households make decentralized location choices was developed in the influential work of Schelling (1971, 1972). Clark (1991) has argued, based on survey data, that preferences of blacks and whites are indeed inconsistent with stable integration in most cities. Others have emphasized the role of racial steering in housing markets and differential access to mortgage credit in accounting for segregation (Yinger, 1995). Still others have advanced the argument that segregation is largely a consequence of socio-economic stratification in residential patterns in the face of racial disparities in income and wealth (Leven et al., 1976, Muth, 1986). While there has been lively debate on the relative importance of preferences and discrimination, there appears to be a broad consensus that racial income disparities are a relatively unimportant factor in accounting for existing patterns of segregation.[2] Farley et al. (1994) go so far as to say that the "the economic explanation has largely been jettisoned."

In this paper we take a fresh look at the question of how much segregation can be accounted for by racial income disparities. We do so by proposing a method for the decomposition of segregation measures into two components. One of these can be interpreted as

[1] The dissimilarity index measures the proportion of one race that must be moved if each neighborhood is to have a racial composition that reflects that of the city as a whole. The reported measures, based on census tract data, have been published online by the Lewis Mumford Center (2001).

[2] See, for instance, Kain (1976), Galster (1988), Denton and Massey (1988), McKinney and Schnare (1989), Farley and Frey (1994) and Ellen (2000).

the component of segregation that can be attributed to the effect of racial income disparities alone, while the other captures the combined effect of neighborhood preferences and discrimination. This method, which is described in some detail below, uses information on the distribution of income within each neighborhood of a metropolitan area. In contrast, most commonly used measures of segregation are based solely on information about race and location.

The argument that racial income disparities are unimportant as determinants of segregation has been based on the finding that the levels of segregation experienced by black households are uniformly high across all income categories (Denton and Massey 1988, Farley and Frey 1994). The examination of segregation indexes disaggregated by income class provides useful information, but cannot be used directly to assess the extent (however modest) to which racial income disparities contribute to segregation. More importantly, in the absence of a single quantitative measure of this effect, it is difficult to make comparisons across metropolitan areas or over time in the extent to which income matters for understanding segregation. Our measure allows us to make such comparisons with ease.

The method we propose is based on the construction of a "hypothetical city" in the following manner. Each neighborhood of the hypothetical city has the same number of households in each income category as the actual city, but the racial composition *within each income category* of each neighborhood is assumed to reflect the city-wide racial composition in that category. The interpretation of the hypothetical city is that it reflects the spatial distribution that would arise if sorting were based on income and idiosyncratic neighborhood preferences alone, in the absence of discrimination or preferences over neighborhood racial composition. Once constructed, a segregation measure for the hypothetical city can be easily computed. This can be interpreted as the level of segregation that is predicted on the basis of racial income disparities and socioeconomic stratification in residential choice alone. The difference between the segregation index for the actual city and that for the hypothetical city may then be interpreted as the component of segregation that cannot be accounted for by income considerations alone, and must therefore be attributed to other effects such as preferences over neighborhood racial composition and discrimination.

Applying this method to thirty major metropolitan areas, we find that the role played by racial income disparities in accounting for segregation is generally modest but varies significantly across cities. Our data is drawn from the 1990 census, and the areas examined are the thirty cities nationwide with the largest populations of black households as selected

by Massey and Denton (1993).[3] Within this sample we find that racial income disparities alone would predict indexes of dissimilarity ranging from 8% to 18% with an average of 12%. This is far lower than the observed dissimilarity indexes which range from 57% to 90% with an average of 75%. This confirms the view that observed levels of segregation are largely due to factors other than racial disparities in income. Nevertheless, we find considerable variation across cities in the extent to which income matters. The proportion of the observed index that can be attributed to income disparities ranges from one-tenth in Miami to almost one-quarter in Memphis. Furthermore, the well documented finding that Southern cities are less segregated than Northern ones appears even more starkly when one looks only at the component of segregation that cannot be accounted for on the basis of income disparities. When comparing the ranking of cities on the basis of this component alone with their ranking on the basis of overall segregation, we find that only one of the ten Southern cities outside Florida rises in rank while eight of the ten decline. In other words, the North-South difference is even sharper when one looks only at the component of segregation that arises from the combined effect of neighborhood preferences over racial composition and discrimination in real estate and credit markets.

The paper is organized as follows. Section 2 describes the method used to achieve a decomposition of segregation measures and Section 3 illustrates this by looking at a simple example. Section 4 presents results for the thirty metropolitan areas and discusses our findings. Section 5 concludes.

2 The Hypothetical City

Consider a metropolitan area with n disjoint neighborhoods. Let B denote the population of black households in the city and W the total population of white households. In neighborhood i the population of black and white households are denoted B_i and W_i respectively. The index of dissimilarity is defined as follows.

$$D = \frac{1}{2} \sum_{i=1}^{n} \left| \frac{B_i}{B} - \frac{W_i}{W} \right|$$

When all neighborhoods have the same racial composition, which therefore mirrors the racial composition of the city as a whole, D is clearly equal to zero. Under complete segregation,

[3] Disaggregated data on income distribution by race within block groups is not yet available for the 2000 census.

when all neighborhoods are racially homogeneous, D takes its maximum value of 1. The index may be interpreted as the proportion of black (or white) households which must move in order for each neighborhood to have the same share of black households as the city as a whole.

Within each neighborhood, each household belongs to one of m distinct income classes. Let B_{ij} denote the number of black households residing in neighborhood i who belong to income class j and define W_{ij} analogously. In the city as a whole, the number of black households in income class j is then $B_j = \sum_{i=1}^{n} B_{ij}$ and the corresponding number of white households is $W_j = \sum_{i=1}^{n} W_{ij}$. In the city as a whole, the share of black households in total (black and white) households belonging to income class j is

$$\beta_j = \frac{B_j}{B_j + W_j}.$$

This corresponds to the probability that a randomly selected household drawn from the group of households in income class j will be black. Similarly, define

$$\omega_j = \frac{W_j}{B_j + W_j},$$

which is the share of white households in total households belonging to income class j.

The hypothetical city is constructed by keeping constant the total population in each income class of each neighborhood, but altering its racial composition to match that of the city as a whole. Using an asterisk to denote populations in the hypothetical city, we have

$$B_{ij}^* = \beta_j \left(B_{ij} + W_{ij}\right) \quad (1)$$

$$W_{ij}^* = \omega_j \left(B_{ij} + W_{ij}\right) \quad (2)$$

Total black and white households in neighborhood i of the hypothetical city are, respectively, $B_i^* = \sum_{j=1}^{m} B_{ij}^*$ and $W_i^* = \sum_{j=1}^{m} W_{ij}^*$. These magnitudes can then be used to compute an index of dissimilarity for the hypothetical city, namely

$$D_s = \frac{1}{2} \sum_{i=1}^{n} \left| \frac{B_i^*}{B} - \frac{W_i^*}{W} \right|.$$

This magnitude sets a lower bound on the possible values that the actual dissimilarity index can take in the following sense: if segregation by race was purely an unintended by-product of socioeconomic stratification, then D_s and D would be equal. If, on the other hand, sorting occurs on the basis of both income and race (or characteristics other than income that are correlated with race), then D will exceed D_s. Let $D_r = D - D_s$ denote the residual component

of the dissimilarity index. This can be interpreted as the amount of segregation which cannot be accounted for by racial income disparities alone. Like the index of dissimilarity, D_r cannot exceed 1. However, unlike D, it is theoretically possible for it to be negative. Negative values would reflect strongly integrationist attitudes reflecting a mutual preference for living with members of the other race over one's own. As we show below, empirical estimates of D_r are significantly greater than zero in all the major metropolitan areas of the United States which we have examined.

3 An Example

The methodology can be illustrated by examining the following three block groups, all of which are in the New York Primary Metropolitan Area (PMSA). Data from the 1990 census are available for nine income classes.[4]

		Income Class								
		1	2	3	4	5	6	7	8	9
Block A	Black	0	0	0	0	0	0	0	0	14
	White	21	37	23	153	147	279	205	105	240
Block B	Black	23	25	6	33	26	38	18	0	0
	White	6	98	23	122	92	62	54	35	0
Block C	Black	54	69	60	122	93	141	43	7	17
	White	7	0	0	0	0	0	0	0	0

Table 1: Data for three New York block groups.

The population share of black households within each income class in the New York PMSA as a whole is as follows

β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	β_9
0.46	0.32	0.30	0.33	0.28	0.24	0.20	0.15	0.07

[4]The block groups are (A) Tract 98, Block 2 (B) Tract 28, Block 1 and (C) Tract 227.01, Block 2. All three are located in Manhattan (New York County). The metropolitan area as a whole consists of eight counties, five of which are in New York City. The income categories are given in Table 3 below.

Recognizing that $\omega_j = 1 - \beta_j$ and applying (1–2) we get the corresponding block groups for the hypothetical city.

		Income Class								
		1	2	3	4	5	6	7	8	9
Block A	Black	10	12	7	51	41	67	42	16	19
	White	11	25	16	102	106	212	163	89	235
Block B	Black	13	40	9	51	33	24	15	5	0
	White	16	83	20	104	85	76	57	30	0
Block C	Black	28	22	18	41	26	34	9	1	1
	White	33	47	42	81	67	107	34	6	16

Table 2: Hypothetical city data for three New York PMSA block groups.

Some comparisons between the actual and hypothetical data help illustrate the methodology. Block A contains 21 households in the lowest income group, all of whom are white. The hypothetical city also contains 21 households in the lowest income group, but these are divided among black and white households in accordance with the fact that city-wide, 46% of all households belonging to the lowest income class are black. This results in 10 black and 11 white households for Block A in the hypothetical city. More generally, the hypothetical city contains more black residents in Block A in each income category than the actual city, reflecting the fact that this block contains a higher proportion of white households in each income category than does the city as a whole. For similar reasons, the hypothetical city contains more white residents in Block C in each income category than the actual city. Block B is considerably more racially integrated than the other two blocks and more closely reflects the racial distribution of the city as a whole in each income class. The data for the hypothetical city accordingly matches that of the actual city far more closely in this block. Note that the total number of residents in each income class of each block is the same; only the racial composition of the households in each class is altered in the construction of the hypothetical city.

In the manner described above, the hypothetical city can be constructed block-by-block using data on the income distribution by race within each block, together with city-wide aggregates. Figure 1 shows actual and hypothetical city data for New York County (Man-

hattan).[5] Despite significant racial disparities in the distribution of income, the black population is spread far more evenly across the hypothetical city. Most parts of the actual city that contain large black populations continue to be disproportionately black in the hypothetical city, but much less strikingly so. The areas with somewhat large black populations in the hypothetical city are precisely those in which average incomes are relatively low: this is a direct consequence of the racial income disparity in the city as a whole. Hence neighborhoods that are poor but predominantly white in the actual city appear as disproportionately black in the hypothetical city, and the racial composition of the hypothetical city provides a visual description of the spacial distribution of income.

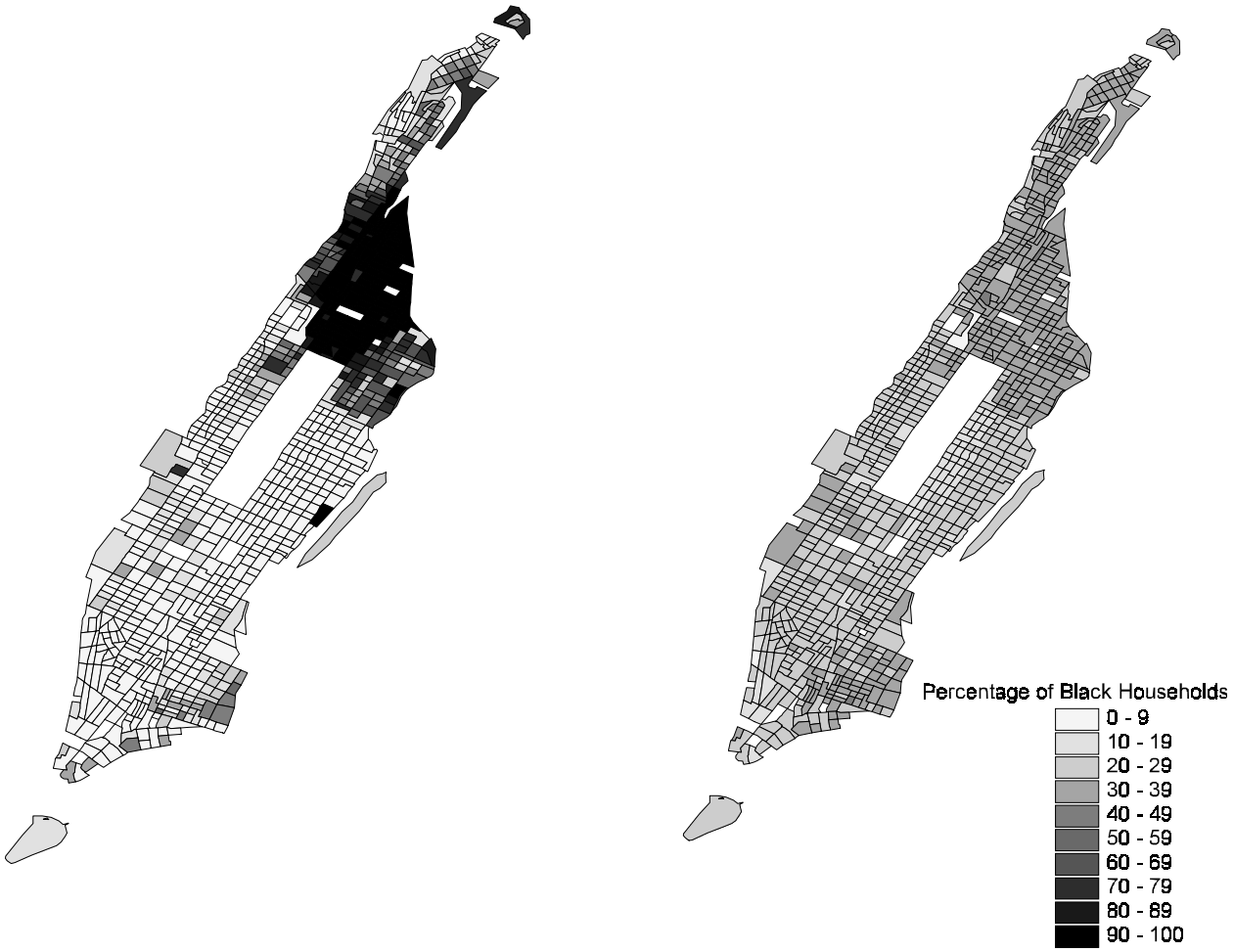

Figure 1. Racial Composition of Manhattan, Actual and Hypothetical.

[5]The hypothetical city is constructed using data from all eight counties in the New York PMSA. A few block groups contain no households: these have been dropped from the map, which accounts for the white 'gaps' appearing in both the actual and the hypothetical city.

Figure 1 suggests that, at least in the case of New York, income disparities play a very modest role in accounting for observed levels of segregation. A quantitative estimate of this role can be obtained by computation of the dissimilarity index for the hypothetical city and comparison with the corresponding index for the actual city. The 1990 census provides all the data required for this to be done, for any metropolitan area in the nation.

4 A Look at the Data

The 1990 Census provides data on income distribution by race at the level of block groups.[6] There are nine income classes, which are displayed in Table 3.

Income Class	Income Range
1	Below $5000
2	$5,000 to $9,999
3	$10,000 to $14,999
4	$15,000 to $24,999
5	$25,000 to $34,999
6	$35,000 to $49,999
7	$50,000 to $74,999
8	$75,000 to $99,999
9	$100,000 or more

Table 3. Income classes in 1990 Census

Table 4 presents some summary statistics for the thirty metropolitan areas with the largest populations of black households, as selected by Massey and Denton (1993). Some cities are part of vast consolidated metropolitan areas (CMSAs) containing multiple nuclei; such areas are further divided into Primary Metropolitan Statistical Areas (PMSAs) each of which can be identified with a single nucleus. For instance Newark and New York belong to different PMSAs but are both part of the same vast CMSA which includes significant

[6] Much of the literature on segregation uses census tracts rather than block groups. We use block groups because they better fit the common understanding of a neighborhood and because tracts that seem integrated can be composed of blocks that are themselves racially homogenous. For instance, Ellen (2000, p.78) finds that about a third of the block groups in a sample of integrated Washington D.C. census tracts are either predominantly black or predominantly white (integrated tracts are defined as those in which the black share of the total population is between 10 and 50 percent).

portions of New York, New Jersey and Connecticut. In selecting the geographic boundaries of metropolitan areas, we have chosen to include only those counties which are part of the PMSA to which the city of interest belongs. For each metropolitan area, the table reports the number of census block groups, the total number of households, and the percentages of households identified as black, white, or neither.[7]

[7]The Metropolitan Areas are as defined by the Office of Management and Budget, 6/30/90, and reported in U.S. Census Bureau (1999). A small number of MSA's contain one or more counties which are not subdivided into census tracts but rather into Block Numbering Areas (BNAs). These counties are typically sparsely populated and described by the census bureau as "nonmetropolitan". For this reason we have excluded them from the analysis. Inclusion of these counties would have a negligible effect on our results.

MSA/PMSA	Blocks	Households	Black	White	Other
Atlanta	2,011	1,056,929	24%	74%	2%
Baltimore	2,001	879,968	23%	75%	2%
Birmingham	828	344,912	25%	75%	1%
Boston	2,704	1,098,045	7%	89%	4%
Buffalo	972	376,019	11%	87%	2%
Chicago	5,295	2,217,399	20%	73%	8%
Cincinnati	1,401	548,138	13%	86%	1%
Cleveland	1,861	712,647	18%	80%	2%
Columbus	1,291	525,558	11%	87%	2%
Dallas	2,343	956,720	15%	77%	8%
Detroit	4,593	1,619,653	20%	78%	2%
Gary-Hammond	591	215,556	18%	78%	4%
Greensboro-Winston Salem-High Point	817	372,191	18%	81%	1%
Houston	2,393	1,187,938	18%	71%	11%
Indianapolis	1,046	480,406	13%	86%	1%
Kansas City	1,506	602,514	12%	86%	2%
Los Angeles-Long Beach	6,008	2,994,343	12%	65%	23%
Memphis	940	357,166	36%	63%	1%
Miami	1,048	692,237	17%	77%	6%
Milwaukee	1,381	538,179	11%	86%	3%
New Orleans	1,255	454,417	31%	67%	2%
New York	6,942	3,248,805	23%	63%	13%
Newark	1,705	650,752	21%	73%	5%
Norfolk-Virginia Beach-Newport News	941	494,145	26	71%	3%
Philadelphia	4,472	1,774,837	18%	79%	3%
Pittsburgh	2,165	819,085	8%	92%	1%
St. Louis	2,196	923,639	16%	83%	1%
San Francisco	1,268	643,565	7%	74%	19%
Tampa-St. Petersburg-Clearwater	1,581	870,999	7%	91%	2%
Washington DC	2,665	1,460,785	25%	69%	6%

Table 4. Descriptive Statistics for 30 Metropolitan Areas

Table 5 contains the computed values of the standard dissimilarity index D and its two components D_s and D_r. For reasons discussed in Section 2, D_s is the component of D that can be attributed to the effects of racial income disparities alone. The residual component of the dissimilarity index is $D_r = D - D_s$, which may be interpreted as the component of the dissimilarity index that cannot be attributed to racial income disparities.

Our findings for the dissimilarity index D conform closely to earlier finding by others. A comparison with Massey and Denton (1993, Table 8.3) shows that all metropolitan areas except one have values for D within five percentage points of those reported earlier, and all but six have values that are within three points.[8] This occurs despite the fact that our analysis is based on block groups rather than census tracts, and the boundaries of our metropolitan areas do not match theirs in every case. A comparison of our values with Farley and Frey's reported results based on block group data (1994, Table 1) show even closer conformity: of the eleven cities in common all are within three points and all but one is within two. In terms of the overall level of segregation, therefore, our findings confirm those reported in earlier studies.

Turning to the values obtained for D_s, we find that racial income disparities account for relatively little of the observed segregation. If segregation were based on socioeconomic stratification alone one would obtain dissimilarity indices ranging from 8% in Miami and Greensboro to 18% in Memphis, with an average for the thirty cities of 12%. This is far below the 75% average in the value of D, and provides support for the view that racial income disparities are not an important factor in explaining the persistence of segregation. Nevertheless, we find substantial variation across cities in the extent to which income matters. In Miami only one-tenth of the dissimilarity index can be attributed to income disparities; in Memphis the corresponding figure is almost one-fourth. This variation can also be seen by comparing the segregation rankings on the basis of D with the rankings on the basis of D_r. As shown in Table 5, the five most segregated MSA's maintain their precise ranks but elsewhere in the distribution, some rankings are quite significantly affected. For instance, Memphis is ranked 16th on the basis of the standard dissimilarity index but drops eight places to 24th on the basis of D_r. Similarly, Cincinnati and Kansas City each drop five places to 15th and 19th respectively. In contrast, Miami rises six places to 13th. New York and Greensboro each rise five places to 6th and 23rd respectively.

[8] The one outlier is Norfolk, for which we obtain a dissimilarity index of 57%, approximately seven points higher than the value they report.

MSA/PMSA	D	D_s	D_r	Rank (D)	Rank (D_r)
Atlanta	69%	13%	56%	24	25
Baltimore	73%	13%	61%	18	20
Birmingham	77%	13%	64%	13	14
Boston	71%	9%	63%	22	18
Buffalo	84%	14%	70%	5	5
Chicago	85%	14%	71%	4	4
Cincinnati	79%	15%	64%	10	15
Cleveland	86%	14%	72%	3	3
Columbus	70%	11%	59%	23	22
Dallas	65%	15%	50%	27	29
Detroit	88%	15%	73%	2	2
Gary-Hammond	90%	13%	77%	1	1
Greensboro-Winston Salem-High Point	65%	8%	57%	28	23
Houston	69%	14%	55%	25	26
Indianapolis	77%	11%	66%	10	11
Kansas City	75%	13%	62%	14	19
Los Angeles-Long Beach	72%	9%	63%	21	17
Memphis	74%	18%	56%	16	24
Miami	73%	8%	65%	19	13
Milwaukee	83%	16%	67%	6	9
New Orleans	72%	15%	57%	20	21
New York	78%	9%	69%	11	6
Newark	82%	13%	69%	7	7
Norfolk-Virginia Beach-Newport News	57%	13%	45%	30	30
Philadelphia	80%	12%	68%	8	8
Pittsburgh	74%	11%	63%	17	16
St. Louis	79%	13%	66%	9	10
San Francisco	64%	10%	54%	29	28
Tampa-St. Petersburg-Clearwater	75%	9%	66%	15	12
Washington DC	67%	13%	54%	26	27

Table 5. Dissimilarity indexes and their components.

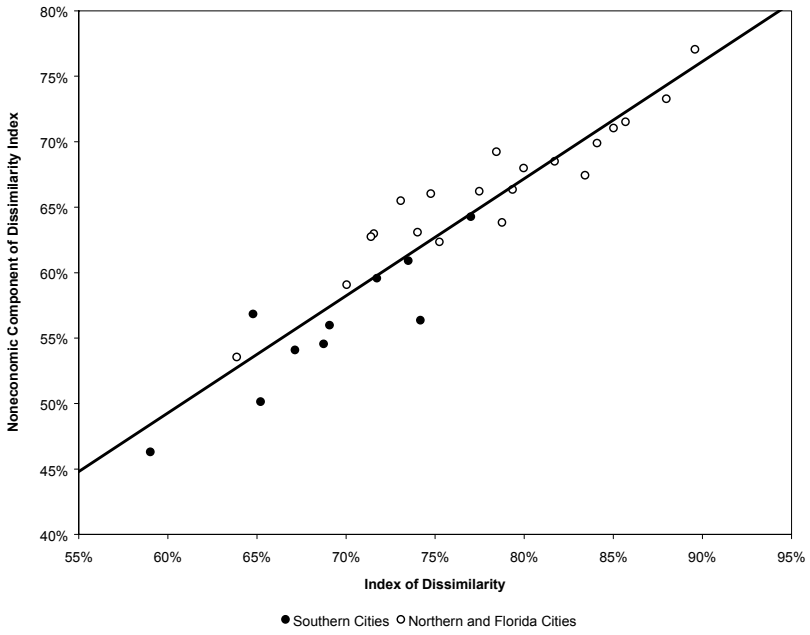

Figure 2. Overall Segregation and Noneconomic Components.

Figure 2 shows the high degree of correlation between D and D_r for the sample of cities. If one divides the sample onto two subsamples consisting respectively of Southern cities outside of Florida and the remaining cities, two interesting patterns can be discerned. First the well-documented pattern of lower segregation in the South is evident both in the dissimilarity index D and its noneconomic component D_r. Second, looking at the regression line through the data points, one sees that all but one of the Southern cities lies below the line while a majority of Northern cities lies above it.[9] In other words, subtracting the economic component from the dissimilarity index results in an even sharper North-South divide in the extent of racial segregation. This can also be seen from the rankings in Table 5. Greensboro is the only one of the ten southern cities outside of Florida to rise in rank under D_r, while eight of the remaining nine drop in rank. Norfolk, already the least segregated area in the sample, maintains this position under D_r. Not only is the South less segregated than the North, but a greater proportion of segregation in the South can be attributed to the effects of racial income disparities.

[9] The one exception in the South is Greensboro. We have grouped the two Florida cities with those outside the South because they contain large populations of northern retirees and display patterns of segregation and stratification that better resemble the cities of the North.

5 Conclusions

The primary contribution of this work is the introduction of a method for the decomposition of segregation measures into two components, one of which captures the effects of income disparities between the segregated groups. The method can also be applied to any segregation measure that is based on race and location alone, such as indexes of isolation, clustering, concentration or centralization, and to any form of spatial segregation based on an observable criteria, such as ethnicity or linguistic preference.

The empirical analysis in the paper serves the purpose of illustrating the method developed here, but provides no more than a glimpse into the complex determinants of residential segregation. A much broader statistical analysis involving multiple census years and a larger group of MSA's can be conducted on the basis of the same method. Such an analysis can be used to probe more deeply into the continuing causes of residential segregation, but is clearly beyond the scope of the present inquiry. The same approach could also be used to identify the extent of segregation that can be attributed to racial disparities in wealth (rather than income), provided that disaggregated data on the distribution of wealth by race at the neighborhood level could be obtained. Racial disparities in accumulated physical and financial assets are significantly greater than those in income (Oliver and Shapiro, 1997). To the extent that stratification by wealth exceeds stratification by income in metropolitan areas, our empirical results will understate the importance of economic disparities in accounting for segregation.

The noneconomic component of the dissimilarity index expresses the combined effects on segregation of neighborhood preferences, discrimination and other factors unrelated to racial income disparities. Use of our decomposition does not permit one to distinguish among these determinants. Our finding that the effect of racial income disparities on contemporary levels of segregation is modest does, however, underscore the importance of examining preferences and discrimination. It also provides a straightforward method of assessing the extent to which narrowing racial income disparities have played a role in recent declines in segregation, and in the increasing stability of integrated neighborhoods in certain areas (Cutler et al., 1999, Ellen, 2000).

While racial disparities in the distribution of income may be a relatively unimportant factor in accounting for existing segregation, our analysis shows that there is sufficient variability across cities in the contribution of this factor to warrant further exploration. We expect, moreover, that the role of racial economic inequality as a determinant of segregation will increase over time. Farley and Frey (1994), for instance, predict a "stronger link between

the economic status of blacks and integration" as the institutionalized segregation of the Jim Crow laws recedes further into the past. By keeping track of the separate components of segregation, such predictions can be given sharp empirical content and tested as new data become available.

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